

EXD. 18h

IMP. DIV.  
13 FEB 1926

ENTOM.

UNIVERSITY OF TENNESSEE  
AGRICULTURAL EXPERIMENT STATION  
Knoxville

---

---

BULLETIN No. 132

MARCH, 1925

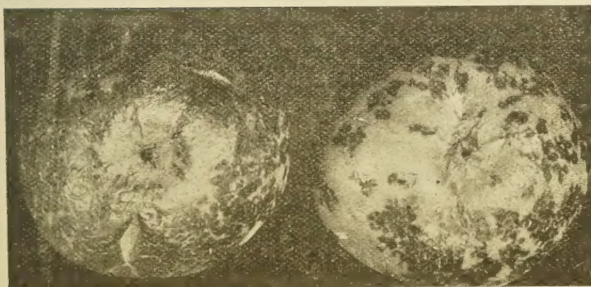
---

---

SPRAYING EARLY APPLES FOR  
BLOTCH CONTROL

By

J. A. McCLINTOCK AND C. D. SHERBAKOFF



TWO BLOTCHED EARLY HARVEST APPLES

The majority of the early apples in commercial orchards looked like this at the time the spray experiments were started.

Printed by  
Stubley Printing Co.  
Knoxville, Tenn.

UNIVERSITY OF TENNESSEE  
AGRICULTURAL EXPERIMENT STATION  
Knoxville

---

H. A. MORGAN, President

---

AGRICULTURAL EXPERIMENT STATION COMMITTEE

W. S. SHIELDS

W. P. COOPER

T. W. HUNTER

---

STATION OFFICERS

C. A. MOOERS, Director and Agronomist  
M. JACOB, Veterinarian and Animal Husbandman  
W. H. MACINTIRE, Soil Chemist  
S. H. ESSARY, Botanist  
C. E. ALLRED, Agricultural Economist  
C. D. SHERBAKOFF, Plant Pathologist  
J. A. MCCLINTOCK, Horticulturist and Associate Plant Pathologist  
S. MARCOVITCH, Entomologist  
W. M. SHAW, Associate Soil Chemist  
J. B. YOUNG, Assistant Soil Chemist  
R. M. BARNETTE, Assistant Soil Chemist  
L. S. MAYER, Assistant Agronomist, cooperative with Office of Cereal Investigations, U. S. D. A.  
HELEN BRYANT, Assistant Plant Pathologist  
S. A. ROBERT, Supt. West Tenn. Exp. Station, Jackson  
L. R. NEEL, Supt. Middle Tenn. Exp. Station, Columbia  
REX E. MARTIN, Assistant in Cooperative Experiments, Crossville  
H. W. JONES, Assistant, Tobacco Exp. Station, Clarksville  
H. P. OGDEN, Assistant in Cooperative Experiments, Murfreesboro  
L. W. BLAIR, Assistant in Cooperative Experiments, Allardt  
F. H. BROOME, Secretary  
VERA WALTON, Assistant Librarian  
CARRIE B. CARTER, Stenographer  
NEDA SWANNER, Stenographer

The Agricultural Building, containing the offices and laboratories of the Experiment Station, the College class rooms, and the headquarters of the Division of Extension, is located at the University Farm, on Kingston Pike, about one mile west of the main campus. Farmers are cordially invited to visit the building and the experimental grounds.

Bulletins of this Station will be sent, upon application, free of charge, to any farmer in the State.

# SPRAYING EARLY APPLES FOR BLOTCH CONTROL

BY

J. A. MCCLINTOCK AND C. D. SHERBAKOFF

---

## INTRODUCTION

Various apple diseases, such as blotch, bitter-rot, scab, and black-rot, are present in orchards throughout Tennessee. Their importance is not fully realized, however, until the growers attempt to produce apples for commercial shipment, the fruit attacked by these diseases being unsuitable for this purpose.

Commercial growers have been following for many years the spray schedule recommended for this State, but the results have been varied, and often quite poor. In the spring of 1923 spray tests were undertaken to determine whether the poor results were due to an incorrect spray schedule, or to a lack of thoroughness in applying the sprays. These tests were located in four commercial orchards of Williamson and Maury Counties, in the heart of the Middle Tennessee early-apple section. They were conducted co-operatively by H. B. Holcombe, W. I. Smith, and S. G. Abernathy, of the Agricultural Extension Service of the University of Tennessee, and C. D. Sherbakoff and J. A. McClintock, of the Experiment Station.

In 1923 the commercial growers in whose orchards the test plants were located followed the approved University spray schedule compiled by N. D. Peacock, of the College of Agriculture, and published as Extension Publication No. 113. The schedule for apples contained in that publication is given on page 4 of this bulletin.

In the test blocks a special schedule was followed which differed from the regular one in that Bordeaux mixture 3-4-50 was used in the place of lime-sulphur for the calyx spray. It also varied in the time of the subsequent applications, which were made one week earlier than called for in the approved schedule.

## EXPERIMENTAL RESULTS

### Season of 1923

In each case the special spray schedule was used on square blocks of 16 trees, while the trees outside these test blocks were sprayed according to the schedule referred to. In the tests the first, or calyx, spray was applied between April 27 and May 1. It soon became evident that the spraying of the test blocks was much more thorough than that of the rest of the trees in the orchards. That

## APPLE SPRAY SCHEDULE

Insects and diseases to be controlled	Materials to be used	Time of application
San Jose scale	Lime-sulphur, 5 degrees Baume (commercial liquid material, diluted 1-7).	<b>Dormant season</b> — Early winter, before February 1st.
Scab Black-rot on leaves Apple aphid Curculio	Lime-sulphur, 1 degree Baume. 40% nicotine sulphate (Black-leaf 40), $\frac{1}{2}$ pint to 50 gals. Arsenate of lead, 1 pound to 50 gallons.	<b>Pink-bud</b> — As the individual buds in a cluster begin to separate.
Scab Black-rot on leaves Codling moth Curculio	Lime-sulphur, 1 degree Baume. Arsenate of lead, 1 pound to 50 gallons.	<b>Petal-fall or calyx spray</b> — Begin when petals are $\frac{3}{4}$ off and finish before the calyx closes.
Blotch Scab Codling moth Curculio	Bordeaux mixture 3-4-50. Arsenate of lead, 1 pound to 50 gallons.	<b>Two-weeks spray</b> — Begin 10 days following last spray and finish by 2 $\frac{1}{2}$ weeks after petal-fall.
Blotch Bitter-rot Black-rot on fruit Scab All leaf-eating insects	Bordeaux mixture 4-5-50. Arsenate of lead, 1 pound to 50 gallons.	<b>Five-weeks spray</b> — Begin two weeks after previous spray, finish by five weeks after petal-fall.
Bitter-rot Blotch Scab Codling moth, 2nd brood	Bordeaux mixture 4-5-50. Arsenate of lead, 1 pound to 50 gallons.	<b>Seven-weeks spray</b> — Begin two weeks after last spray.
Bitter-rot Blotch Black-rot on fruit Scab Sooty-blotch Leaf-eating insects	Bordeaux mixture 4-5-50.	<b>Late-season sprays</b> — Repeat as needed (especially in hot weather), until two weeks before harvest.

In each case the powdered form of arsenate of lead is referred to in the above schedule.



is, the twigs, leaves, and young fruits in the test blocks were completely covered with spray material, while those outside the test blocks showed from 10 to 50 per cent of the surfaces unprotected by spray material. This was also observed in subsequent applications throughout the season. This difference in thoroughness was due to the growers' spraying the trees outside the test blocks as they had been accustomed to spraying, while the test trees were carefully sprayed under expert supervision from the Experiment Station.

In order that definite data might be obtained on the relative effectiveness of the two spray schedules as regards freedom of the fruit from disease, from 5 to 15 bushels of fruit in each case was taken from trees both within and without the test blocks. As the data show important differences only in the amount of healthy and of blotched fruit, the individual figures for the other diseases, and for the insect injuries, are omitted from consideration.

The figures in Table 1 do not tell the whole story, because in the test blocks all fruits which showed signs of blotch were recorded as diseased even though the infection was so slight that the fruit graded No. 1, while on many of the blotched fruits from the rest of the orchard the infection was so serious that the apples were graded as culls. The figures show a great difference, however, in favor of the test spraying—the average for the four demonstrations being 63 per cent more healthy fruit and 63 per cent less blotched fruit from the test blocks than from the trees outside the test blocks.

TABLE 1—Results of 1923 spray tests with Early Harvest apples

Orchard No.	Trees outside demonstration blocks			Trees in demonstration blocks		
	Healthy	Blotched	Other diseases and insect injuries	Healthy	Blotched	Other diseases and insect injuries
	%	%	%	%	%	%
1	8	90	2	No demonstration test		
2	49	44	7	90	7	3
3	33	64	3	93	5	2
4	29	69	2	97	1	2
Average	30	67	3	93	4	2

TABLE 2—Results of 1924 spray tests with Early Harvest, Duchess, and Yellow Transparent apples

Orchard No.	EARLY HARVEST						DUCHESS						YELLOW TRANSPARENT					
	Trees outside demonstration blocks			Trees in demonstration blocks			Trees outside demonstration blocks			Trees in demonstration blocks			Trees outside demonstration blocks			Trees in demonstration blocks		
	Healthy	Blotched	Other diseases and insect injuries	Healthy	Blotched	Other diseases and insect injuries	Healthy	Blotched	Other diseases and insect injuries	Healthy	Blotched	Other diseases and insect injuries	Healthy	Blotched	Other diseases and insect injuries	Healthy	Blotched	Other diseases and insect injuries
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
1	94	2	4	90	1	9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2	83	12	5	89	8	3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
3	79	6	15	89	1	10	.....	.....	.....	.....	.....	.....	.....	.....	.....	98	0.2	1.8
4	66	9	25	64	4	32	62	32	6	81	13	6	.....	.....	.....	.....	.....	.....
5	.....	.....	.....	.....	.....	.....	75	21	4	88	7	5	.....	.....	.....	.....	.....	.....
6	54	26	20	80	5	15	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Average	75	11	14	82	4	14	68	26	5	84	10	6	.....	.....	.....	80	16	4
																98	0.2	1.8

Average for all blocks: Outside trees—Healthy 74%, blotched 18%; Demonstration—Healthy 88%, blotched 5%.

### Season of 1924

The tests of 1924 differed from those of 1923 in several respects. A 2-4-50 Bordeaux mixture was used instead of the 3-4-50 mixture of the preceding year; the test blocks were enlarged to the number of trees which could be sprayed with one 200-gallon tank of mixture; and the tests were conducted in six commercial orchards instead of four as in 1923. The weaker Bordeaux mixture, 2-4-50, was used because of the satisfactory results obtained with it by the Indiana Experiment Station, where blotch was effectively controlled and the percentage of Bordeaux injury, known as russetting, was reduced.

Table 2 gives the results obtained in 1924 on the Early Harvest, Duchess and Yellow Transparent varieties.

The results presented in Table 2 show that the 2-4-50 Bordeaux mixture is effective in the control of blotch on early apples in Tennessee. As a result of the 1923 tests, growers had learned that thoroughness pays; therefore they sprayed the trees outside the test blocks much more thoroughly in 1924 than in 1923. The better control obtained in 1924 on trees outside the test blocks as compared with 1923 results indicates that thoroughness of application is a very important factor.

In all cases both in 1923 and 1924 a caseinate of lime spreader (Kayso) was added to the special sprays used on the test blocks, and this material appeared to facilitate the thorough covering of the fruit, leaves, and twigs.

### CONCLUSIONS

From the results obtained during the seasons of 1923 and 1924 the conclusion cannot be reached that Bordeaux mixture is enough more effective than lime-sulphur for the calyx spray to justify a change in the present spray schedule.

The results obtained with the 2-4-50 Bordeaux mixture in 1924 when compared with those obtained with 3-4-50 and 4-5-50 in 1923 indicate that the weaker Bordeaux is as effective in disease-control and results in less Bordeaux injury.

The successful control of diseases in the test blocks of all orchards in 1923 and 1924 indicates the importance of thoroughness. This was substantiated by the fact that the more thorough spraying of the growers in 1924 resulted in a great reduction in diseases as compared with 1923. A majority of the growers in whose orchards these tests were conducted stated that in their opinion the degree of thoroughness of the application is a more important consideration than the material to be used.



## RECOMMENDATIONS

As a result of the two years' tests it is recommended that for blotch control on early apples, at least four summer sprays be applied—starting with the calyx spray, followed at two-week intervals with subsequent sprays. If apple scab is serious, a pink-bud spray with lime-sulphur (see schedule, page 4) should precede the calyx, or first blotch, spray.

Both lime-sulphur and 2-4-50 Bordeaux mixture have proved effective in blotch control in the calyx spray, and either should give satisfactory results if thoroughly applied. The addition of a caseinate of lime spreader to the spray mixture probably facilitates thoroughness of application.

Acknowledgments: Much of the success of these tests is due to the hearty cooperation of N. B. Rue, Henry Pointer, Lucius P. Brown, T. H. Barrow, Horace Rainey, Jr., and I. C. Murphy, in whose orchards these tests were conducted. Credit is also due N. D. Peacock, of the College of Agriculture, for helpful suggestions and assistance in initiating the 1923 tests.



FRUIT FROM A TEST BLOCK SPRAYED ONE YEAR

The rear twelve bushels of fruit are healthy; there is a small amount of cedar rust, russet, and insect injury on the inverted baskets, and of blotch and rosy aphid in the two partly filled baskets in the foreground. This shows the large percentage of healthy fruit produced by proper spray methods.